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Applicant : Raphael Rahamim, et al.  
Application No. : 09/901,558  
Filed : July 10, 2001  
Title : SINGLE ENDED ANALOG FRONT END  
Grp./Div. : 2644  
Examiner : To be assigned  
Docket No. : 39852/CAG/B600

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents  
Washington, D.C. 20231

Post Office Box 7068  
Pasadena, CA 91109-7068  
October 26, 2001

Commissioner:

Before examination please amend the above-identified application, as follows:

In the Claims:

Please cancel claims 1-58 without prejudice.

Please add new claims 59-110 as follows:

59. (New) An analog front end for a digital subscriber line (DSL) modem, the analog front end comprising:

a single-ended receive channel;

a single-ended transmit channel; and

a converter configured to convert a differential input signal from a twisted pair telephone line to a single-ended input signal for the receive channel, and convert a single-ended

output signal from the transmit channel to a differential output signal for transmission on the twisted pair telephone line.

60. (New) The analog front end of claim 59 wherein the converter comprises a two-way terminal coupled to the receive and transmit channels.

61. (New) The analog front end of claim 59 wherein the converter comprises a transformer having a single secondary winding.

62. (New) The analog front end of claim 61 wherein the secondary winding is grounded at one end.

63. (New) The analog front end of claim 62 wherein the secondary winding comprises a two-way terminal at another end, the two-way terminal being coupled to the receive and transmit channels.

64. (New) The analog front end of claim 59 wherein the receive channel comprises a line driver in combination with a filter.

65. (New) The analog front end of claim 59 wherein the transmit channel comprises a line driver in combination with a filter.

66. (New) The analog front end of claim 59 wherein the receive channel comprises an amplifier having automatic gain control.

67. (New) The analog front end of claim 66 wherein the automatic gain control comprises a variable attenuator configured to attenuate the single-ended input signal.

68. (New) The analog front end of claim 67 wherein the variable attenuator comprises a voltage controlled resistor.

69. (New) The analog front end of claim 68 wherein the voltage controlled resistor comprises a field effect transistor.

70. (New) The analog front end of claim 69 wherein the field effect transistor comprises a first part coupled to the amplifier, a second part coupled to a bias voltage, and a gate configured to receive a voltage to control the attenuation of the single-ended input signal.

71. (New) The analog front end of claim 70 wherein the first part of the field effect transistor comprises a drain and the second part of the field effect transistor comprises a source.

72. (New) The analog front end of claim 59 wherein the receive channel comprises an echo canceller.

73. (New) The analog front end of claim 72 wherein the echo canceller is responsive to the single-ended input signal and the single-ended output signal.

74. (New) The analog front end of claim 73 wherein the echo canceller comprises a comparator configured to compare the single-ended input signal and the single-ended output signal.

75. (New) The analog front end of claim 59 further comprising a filter disposed between the twisted pair telephone line and the converter, the filter having a plurality of components each having a breakdown voltage level sufficient to withstand lightning.

76. (New) The analog front end of claim 75 wherein the components comprises a plurality of series capacitors and shunt inductors.

77. (New) An analog front end for a digital subscriber line (DSL) modem, the analog front end comprising:

receive means for receiving a single-ended input signal;

transmit means for transmitting a single-ended output signal; and

converter means for converting a differential input signal from a twisted pair telephone line to the single-ended input signal for the receive means, and converting the single-ended output signal from the transmit means to a differential output signal for transmission on the twisted pair telephone line.

78. (New) The analog front end of claim 77 wherein the receive means comprises means for amplifying and filtering the single-ended input signal.

79. (New) The analog front end of claim 77 wherein the transmit means comprises means for amplifying and filtering the single-ended output signal.

80. (New) The analog front end of claim 77 wherein the receive means comprises distortion reduction means for reducing distortion.

81. (New) The analog front end of claim 80 wherein the distortion reduction means comprises an echo canceller.

82. (New) The analog front end of claim 80 wherein the distortion reduction means comprises an amplifier having automatic gain control.

83. (New) The analog front end of claim 77 wherein the receive means comprises an amplifier having automatic gain control means for controlling gain of the amplifier.

84. (New) The analog front end of claim 83 wherein the automatic gain control means comprises variable attenuation means for attenuating the single-ended input signal.

85. (New) The analog front end of claim 84 wherein the variable attenuation means comprises a voltage controlled resistor.

86. (New) The analog front end of claim 85 wherein the voltage controlled resistor comprises a field effect transistor.

87. (New) The analog front end of claim 86 wherein the field effect transistor comprises a first part coupled to the amplifier, a second part coupled to a bias voltage, and a gate configured to receive a voltage to control the attenuation of the single-ended input signal.

88. (New) The analog front end of claim 87 wherein the first part of the field effect transistor comprises a drain and the second part of the field effect resistor comprises a source.

89. (New) The analog front end of claim 77 wherein the receive means comprises echo cancellation means for cancelling an echo on the single-ended input signal.

90. (New) The analog front end of claim 89 wherein the echo cancellation means is responsive to the single-ended input signal and the single-ended output signal.

91. (New) The analog front end of claim 90 wherein the echo cancellation means comprises means for comparing the single-ended input signal and the single-ended output signal.

92. (New) The analog front end of claim 77 further comprising a plurality of components disposed between the twisted pair telephone line and the converter means, the components each having a breakdown voltage level sufficient to withstand the lightning.

93. (New) The analog front end of claim 92 wherein the components comprises a plurality of series capacitors and shunt inductors.

94. (New) A method of interfacing to a twisted pair telephone line in digital subscriber line (DSL) modem, comprising:

receiving a differential input signal from a twisted pair telephone line;  
converting the differential input signal to a single-ended input signal;  
converting a single-ended output signal to a differential output signal; and  
transmitting the differential output signal over the twisted pair telephone line.

95. (New) The method of claim 94 further comprising filtering and amplifying the single-ended output signal.

96. (New) The method of claim 94 further comprising filtering and amplifying the single-ended input signal.

97. (New) The method of claim 96 further comprising amplifying the single-ended input signal with automatic gain control.

98. (New) The method of claim 97 wherein the automatic gain control comprises attenuating the single-ended input signal.

99. (New) The method of claim 97 wherein the attenuation is performed with a voltage controlled resistor.

100. (New) The method of claim 99 wherein the voltage controlled resistor comprises a field effect transistor.

101. (New) The method of claim 94 further comprising processing the single-ended input signal to reduce distortion.

102. (New) The method of claim 101 wherein the processing is performed with an echo canceller.

103. (New) The method of claim 102 wherein the echo canceller comprises a comparator.

104. (New) The method of claim 94 further comprising filtering the differential input signal with a plurality of components each having a breakdown voltage level sufficient to withstand the lightning.

105. (New) The method of claim 104 wherein the components comprises a plurality of series capacitors and shunt inductors.

106. (New) A lightning protection circuit, comprising:  
a plurality of series capacitors and shunt inductors each having a breakdown voltage level sufficient to withstand lightning.

107. (New) An automatic gain control circuit, comprising:  
an amplifier; and  
a field effect transistor comprising a first part coupled to the amplifier, a second part coupled to a bias voltage, and a gate configured to receive a voltage to control attenuation of the amplifier.

108. (New) The automatic gain control of claim 107 wherein the first part of the field effect transistor comprises a drain and the second part of the field effect transistor comprises a source.

109. (New) The automatic gain control of claim 107 further comprising a second amplifier coupled to the amplifier and a second field effect transistor coupled to the second amplifier, the second field effect transistor having a first part coupled to the second amplifier, a second part coupled to a second bias voltage, and a gate configured to receive a second voltage to control attenuation of the second amplifier.

110. (New) The automatic gain control of claim 109 wherein the first part of the field effect transistors each comprises a drain and the second part of the field effect transistors each comprises a source.

**REMARKS**

Claims 1-58 have been canceled without prejudice and claims 59-110 have been added.  
Entry of the foregoing amendment is respectfully requested.

Respectfully submitted,

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